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Accelerated rehabilitation after arthroscopic Bankart repair in professional footballers

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Abstract

Background: Advances in arthroscopic surgery have resulted in biomechanically stronger repairs that might allow for accelerated rehabilitation protocols and hence faster return to play. Evidence for such regimes in the shoulder, particularly in elite athletes, is lacking.

Methods: This prospective single surgeon (PB) series included 34 professional footballers undergoing an accelerated rehabilitation programme following arthroscopic soft tissue stabilization subsequent to traumatic anterior shoulder dislocation. Data were collected on time to regain elevation range, external rotation range, return to play and rate of recurrence.

Results: Mean follow-up time was 4.8 years (range 2 years to 10 years). Full range of forward elevation was regained at a mean of 5 weeks (range 3 weeks to 7 weeks) and external rotation range (in neutral) at a mean of 6 weeks (range 4 weeks to 8 weeks). Mean return to play time was 11 weeks (range 9 weeks to 14 weeks). Three players (9%) reported a recurrent episode of dislocation at a mean of 19 months.

Conclusions: An accelerated rehabilitation programme resulted in a return to play time of 11 weeks compared to previously reported times of between 5 months and 9 months in the contact sports population. A recurrence rate of 9% compares favourably to other published studies following similar surgery (5.1% to 28.6%) but which employed more conservative postoperative rehabilitation regimes.

Keywords

arthroscopy, football, physiotherapy, rehabilitation, shoulder

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Introduction

Arthroscopic shoulder surgery has progressed markedly over the past 20 years[1] and surgical preference for arthroscopic versus open stabilization has almost quadrupled in the UK in the last 10 years.[2] Developments in the strength and technology of implants and less invasive surgical procedures have allowed the potential to shorten the recovery period and hence the return to play times for patients; however, there is currently little evidence to support this in the shoulder. Although accelerated rehabilitation regimes are well described in the knee,[3,4] there is a lack of commensurate investigation with respect to the shoulder and, more specifically, stabilization surgery.

Traditional rehabilitation regimes post arthroscopic stabilization commonly stipulate a period of immobilization of between 2 weeks and 6 weeks.[1] This is apparently embedded in practice and is reportedly based on tissue healing times.[5] In the case of labral surgery, however, the development of stronger implants and specifically suture anchors, together with advances in surgical technique,[1,6] all potentially challenge such a conservative approach to management. It is well reported that deficits in external rotation, strength

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and proprioception are associated with poor long-term outcomes.[7–9] Because prolonged periods of immobilization have been shown to result in stiffness, reduction in strength and proprioception,[10,11] rehabilitation regimes that enable early instigation of exercises to address these factors may have the potential to improve long-term outcomes and accelerate return to function.

The elite and professional sporting population pose a particular challenge as a result of long return to play times (and consequently the increasing pressures to reduce these), higher reported recurrence rates and problems with athletes returning to their previous level of performance.[9] In male athletes, aged less than 25 years, with a first-time traumatic anterior dislocation, the risk of recurrence without surgery is reportedly as high as 90–95% with progressive injury patterns of the antero-inferior capsular-labrum-ligamentous complex.[12–14] Surgery continues to be the recommended treatment of choice for this patient group;[6] however, there is a lack of evidence to guide or support the application of accelerated rehabilitation protocols in this group. The present study aimed to prospectively evaluate the efficacy of an accelerated rehabilitation regime for professional footballers undergoing early arthroscopic stabilization for first-time anterior dislocation in terms of clinical outcome, return to play data and recurrence rates.

Materials and methods

This was a prospective single surgeon (PB) series including 34 professional footballers (predominantly playing for football clubs in the Premiership) who were operated on between 2005 and 2013. Players were included based on their history of a clear mechanism of injury resulting in traumatic anterior dislocation, with clear evidence of labral injury confirmed on magnetic resonance imaging. Some 82% of players ($n = 28$) were operated on acutely, at a mean of 9 days post injury (range 2 days to 21 days). The remaining players had surgery over 6 months following their original injury; this was as a result of the deliberate timing of surgery out of season or an original good response to conservative management. The mean age of subjects was 23 years (range 17 years to 33 years); however, 60% of subjects were aged 21 years or under. Players were followed up for a mean of 4.8 years (range 2 years to 10 years). Outcome measures recorded were time to regain elevation range, time to regain external rotation range, time to return to play and rate of recurrence. In addition, the Beighton score was measured pre-operatively and glenohumeral joint laxity was assessed under anaesthetic at the time of surgery.

Intra-operative findings confirmed that 44% of players had a Bankart lesion extending from 12 to 6 o'clock and 56% from 2 to 6 o'clock. Some 81% of subjects had a small to moderate non-engaging Hill–Sachs lesion. Three patients had a glenoid labrum articular disruption and three had a bony Bankart lesion that involved less than 5% of the articular surface.

Operative technique

The operative technique was standardized. All labral repairs were performed by a single surgeon (PB) using suture anchors. After mobilization of the labrum, the capsule and labral remnant were repaired using a non-absorbable GII (DePuy Mitek, Raynham, MA, USA) metal anchor loaded with Orthocord inferiorly and supplementary anchors above. Typically, two further anchors were used and these tended to be absorbable [Bioknotless or Lupine anchors (Mitek) or Pushlock (Arthrex, Naples, FL, USA)]. Excess capsular tissue was incorporated in the repair to correct any capsular laxity. The repair was assessed intra-operatively to determine when, in external rotation, the repair came under tension.

Postoperative rehabilitation

The postoperative rehabilitation regime involved early active supported mobilization from the second post-operative day. The term 'accelerated' relates to the early instigation of active mobilization: rehabilitation aimed to facilitate the early restoration of range of movement, strength and proprioceptive abilities to ensure early safe return to play. To achieve this, a safe zone of mobilization was stipulated by the surgeon, which was based on the passive range achievable without undue stress on the surgical repair (observed intra-operatively). In general, this enabled patients to mobilize up to 120° to 140° of elevation anterior to the scapula plane and to 50% of their pre-operative external rotation range in neutral elevation. The surgeon ensured that the physiotherapist was informed regarding soft tissue status and the presence of inflammation together with any other significant preoperative findings. Closed kinetic chain exercises, isometric exercises and through range recruitment exercises (incorporating the kinetic chain) were also instigated in the first week postoperatively. Players were still asked to wear a sling for between 2 weeks and 3 weeks without a waistband.

Exercise progression was based on pain, scapula congruence, movement pattern and passive range of movement: patients had to achieve specific goals before they were able to progress to the next phase. Although approximate timescales are detailed in Figure 1, these are based on the specific experience with this series of patients. In reality, the phases are

Figure 1: Rehabilitation Outline

Phase 1. (0-4 weeks)

Goals:

- Patient education
- Protect the anatomical repair
- Diminish pain and inflammation
- Regain active range of movement within safe zone*
- Promote improved proprioceptive acuity/neuromuscular control
- Promote optimal recruitment dynamic stabilisers through safe zone*
- Maintain/minimise impact cardio-vascular fitness

* Safe zone stipulated by Surgeon in operation notes.

Rehabilitation:

- **No** combined abduction/external rotation
- **No** forced end range mobilisation especially external rotation with arm by side

- Active assisted/active supported mobilisation within safe zone
- Closed kinetic chain/ proprioceptive exercises
- Cuff /scapula facilitation exercises including isometrics & through range activation
- Incorporate kinetic chain to cuff/scapula exercises
- Encourage use of hand in sling (light activities)
- Cardio-vascular fitness e.g. Bike/incline treadmill (walk)

Phase 2. (3-10 weeks)

Goals:

- Restoration functional range of movement including full elevation range
- Re-educate cuff recruitment and scapula control through full range
- Prevent compensatory movement patterns that may compromise recovery
- Re-educate neuromuscular / proprioceptive function
- Regain optimal strength upper quadrant
- Preserve integrity surgical repair
- Increase/return cardio-vascular fitness and introduce non-contact

Rehabilitation:

Avoid **passive** stretching into combined abduction/external rotation however can encourage active movement/recruitment into this position as long as good control and no apprehension.

- Progress cuff and scapula recruitment through range and emphasise into risk positions (plus load)
- Progress strengthening cuff/scapula muscles with kinetic chain integration
- Preparatory & reactive stabilisation exercises including perturbation work/rhythmic stabilisations in closed and open chain positions
- Closed kinetic chain work into 'risk' positions
- Work opposite arm at high MVC in risk positions
- Increase cardiovascular work- introduce running and non-contact drills

Late stage (6-16 weeks)

Goals:

- Ensure regain optimal range of movement into combined positions
- Optimise proprioception/neuromuscular control
- Ensure preparatory and reactive stabilisation sufficient to withstand load in risk positions
- Restore optimal cuff and scapula control through range and under load
- Optimise function specific power, strength and endurance
- Ensure cuff/scapula strength parameters comparable to opposite arm
- Return to full work/ sport and recreational activities
- Ensure confidence /lack of apprehension in risk positions

Rehabilitation:

- Neuromuscular control through range and incorporated with kinetic chain
- Function specific plyometrics
- Closed kinetic chain exercises into risk positions (increase load and perturbations)
- Function specific strengthening and endurance exercises ensuring local control maintained
- Progress through range strengthening rotator cuff and scapula musculature- isolated and combined with kinetic chain
- Preparatory and reactive stabilisation drills in risk positions
- Controlled falling drills
- Progressive return to full contact training

NB. Players have to achieve key criteria to progress from one phase to the next relating to passive range of movement, pain levels, kinetic chain function (previous injury history) and rotator cuff/scapula muscle function.

Figure 1. Rehabilitation outline.

not time-specific but patient specific and goal driven. The rehabilitation programme (Figure 1) is not intended to be prescriptive but is a guide to delineate key inclusions in the rehabilitation process. Specific exercise selection was individualized according to the player's injury history and playing position. Communication between the surgeon, player and physiotherapists was paramount in optimizing

progression rates. The club physiotherapists were responsible for supervising rehabilitation; however, a physiotherapist specializing in shoulder rehabilitation (JG) reviewed patients at regular intervals and advised regarding progression parameters.

Results

Thirty-four professional footballers (position played at time of dislocation illustrated in Figure 2) undergoing primary arthroscopic stabilization were followed up for a mean of 4.8 years (range 2 years to 10 years). The mean return to play time was 11 weeks (range 9 weeks to 14 weeks). There was a consistent trend of faster return to play times over the study period, decreasing from 14 weeks to 9 weeks. Players regained full range of forward elevation at a mean of 5 weeks (range 3 weeks to 7 weeks) and external rotation range (in neutral) at a mean of 6 weeks (range 4 weeks to 8 weeks).

Three players (9%) reported a further dislocation at a mean of 19 months (Table 1). In two players, this was associated with a further significant trauma and occurred 2 years after surgery. In the third player, failure occurred at 8 months post surgery and was associated with a low velocity training injury during a tackle. This individual was identified as having glenohumeral joint laxity (bilaterally) and a Beighton score of 5 out of 9. All of the players who suffered a recurrence of instability were aged less than 20 years. On liaison with the club physiotherapists, it appeared that all three players had ceased to do specific cuff/scapula recruitment exercises after approximately 6 months postoperatively because their shoulders felt 'normal'. They had returned to usual strength and conditioning training. Two of the players had suffered hamstring injuries in the contralateral lower limb during the 6 weeks preceding the recurrence of shoulder instability.

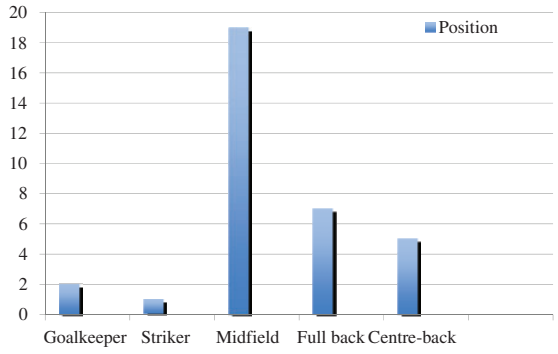

Figure 2. Position played at time of injury.

Discussion

Accelerated rehabilitation

The term 'accelerated rehabilitation' was utilized in the present study for the purposes of comparison with the current literature. In reality, the reported studies relating to accelerated rehabilitation in post-stabilization patients essentially involve early mobilization within a restricted range of movement.[15,16] The prospective randomized trial by Kim et al.[15] is one of only two studies to specifically report the effectiveness of an accelerated rehabilitation regime following arthroscopic Bankart repair. However, their study excluded the elite sporting population and only included patients with a small Bankart lesion limited to 1 cm above the mid-glenoid notch: Kim et al.[15] allowed early mobilization up to 90° of elevation until week 3 and then mobilization was progressed as the symptoms allowed. Law et al.[16] retrospectively evaluated the surgical outcomes of young active patients with arthroscopic Bankart repair within 1 month after first-time dislocation. In their study, there was a standardized mobilization programme, which allowed elevation within the limits of

Table 1. Details of players reporting recurrence.

Age at time original surgery	Position	Bankart lesion size	Presence and size bony Bankart	Inverted pear glenoid?	Laxity?	Time to recurrence	Mechanism of recurrence
18	Central midfield	2–6 o'clock	Yes < 5%	No	No	2 years and 1 month	Abduction/external rotation blocking injury at speed
19	Right back	2–5.30 o'clock	No	No	Yes	2 years	Training injury low velocity
17	Midfield	2–6 o'clock	Yes < 5%	Yes	No	8 months	Fall onto outstretched hand

pain from 3 days postoperatively. Combined movements were allowed from week 4 with the introduction of strength training at 6 weeks. The focus of both of these studies was on the early restoration of elevation range and early instigation of active external rotation. In both studies, the advantages of accelerated rehabilitation were reported as lesser postoperative pain, earlier gain of shoulder motion, earlier return to functional activity and better patient satisfaction with postoperative care. However, neither paper was specific to an elite sports population.

The term accelerated in the current shoulder literature shoulder relates specifically to the instigation of early mobilization within a restricted range of movement. In our series, 'accelerated' would perhaps be better represented by terms such as 'enhanced' or 'optimized': the aim of early mobilization within a zone that prevented compromise of the surgical repair was to enable the early application of strength and proprioceptive training and was tailored to individual players.

Timing of surgery and patient population

As a result of the elite nature of the players included in the present study, 82% were operated on within 9 days of injury. A prerequisite of surgery was that players had regained full range of elevation movement post dislocation. Early intervention potentially reduces the consequences of injury with respect to strength and proprioceptive deficits and therefore potentially facilitates an earlier return to play. The literature is clear that an increased number of recurrent dislocations and a lengthier time to surgery are factors associated with increased risk of failure.[17] However, it is of note that there was no statistically significant difference in return to play time between those players who were operated on acutely and those in whom surgery had been delayed. Importantly, however, within this specific population, all of those with a delay to surgery had had consistent physiotherapy input during the presurgical period to minimize the consequences of injury.

The implementation of an accelerated approach to postoperative rehabilitation in the present study was purposely undertaken in an elite football population. The elite athlete benefits from an increased level of therapy intervention and supervision and is clearly likely to be highly motivated. In addition, conditioning, baseline strength, performance parameters and healing capacity are likely to be far greater than in a non-elite population. There is no doubt that the football players included in this series had a high level of supervision; nonetheless, the same rehabilitation principles have subsequently been adopted in the non-elite (National Health Service based) population with promising effect. Early mobilization within a safe zone, combined with the rehabilitation protocol shown in Figure 1, has resulted in a comparable downward trend in return to sport rates in the non-elite population. This is despite a more limited physiotherapy input (commonly, once a week intervention). It is also of note that original study by Kim et al.[15] was specifically in the non-athletic population. Patient selection within the non-elite population is paramount because compliance is an essential requirement of early mobilization regimes.

Return to play times and level of performance

The delineation between contact and non-contact athletes is key when comparing the findings of different studies and it is of note that, in the current literature, football (or soccer) is commonly included in the contact or collision group. Clearly, this is open to debate and the relative risk of sustaining a shoulder dislocation playing football (2% to 4%[18]) compared to a sport such as rugby (20%[19]) is significantly less. However, although the football population is at less risk of shoulder injury, there is an equivalent impact in terms of days lost to play[18]. Furthermore, the incidence of significant shoulder injuries requiring surgery, most commonly relating to dislocation, has increased in professional football over the last decade.[20]

In those reported series specifically including the sporting population, rehabilitation regimes are commonly conservative. Stein et al.[8] delayed mobilization for 4 weeks and placed continued restrictions on external rotation range until 3 months postoperatively. In their study, the mean return to play was 6.5 months. In the study by Castagna et al.[13] involving adolescent athletes, patients were immobilized for 4 weeks before commencing active mobilization. Strength training was introduced at 8 weeks. Athletes were allowed back to sport at 5 months postoperatively. Studies consistently report return to play times of between 5 months and 9 months in the collision sports population.[21,22] The majority of studies include a heterogeneous group of sports and sub-group them according to upper limb demands.

Hart et al.[20] provide the only study to date to specifically report return to play times in a football population. Although their study incorporated a heterogeneous group of injuries, shoulder dislocation requiring surgery was the most common. They report that players could expect to return to play in less than 12 weeks. Although the specifics of rehabilitation are not reported, it is of note that the senior author in study by Hart et al.[20] advocates early mobilization within a stipulated safe zone. The present study is the first to prospectively study an elite group of professional footballers specifically undergoing arthroscopic Bankart repair surgery.

It is recognized that a percentage of elite athletes fail to achieve pre-injury performance levels following stabilization surgery.[23] In the present study, all players returned to play with their clubs, in their previous position and continued to play at their pre-injury level.

Further to the present study, we have observed a continued downward trend in return to play times with several athletes returning to play in less than 8 weeks. This highlights the importance of robust return to play measures. One of the fundamental challenges of ensuring safe return to play is the lack of sports specific testing procedures and a dearth of normative date regarding strength ratios and other measures. It is clear that isolated performance tests lack validity to predict injuries and therefore a battery of tests, reflecting the specific functional demands of the individual, gives the best value. We have employed a comprehensive set of functional tests incorporating range of movement, strength, fatigue resistance, perturbation control applied both to the shoulder and the rest of the kinetic chain, together with psychological and extrinsic considerations, to ensure that the athlete is fit to return to play. This is clearly a decision that is made with the surgeon, physiotherapist, player and coaching staff.

Recurrence rates

A key aim in evaluating the accelerated rehabilitation programme was to ensure that an early return to play was not reflected in an increase in recurrence rate.

Young age (<25 years), male sex and sporting participation are three of the most significant risk factors in predicting recurrence.[24,25] Reported failure rates in collision athletes, following arthroscopic soft tissue stabilization surgery, range from 5.1% to 28.6%.[8,13,26] In addition, the results of long-term studies have emphasized that recurrence is frequent even 2 years after surgery and a longer follow-up is needed to reveal the real recurrence rate after arthroscopic Bankart repair.[27–29] In the present study, at a mean of 4.8 years follow-up, the recurrence rate was 9%; the three players suffering recurrence of instability were all aged under 20 years. This recurrence rate compares favourably with recurrence rates reported in other studies of professional sportsmen.[8,13,26,27]

Limitations

Deficits in external rotation range of movement, strength and proprioception have been well reported as factors associated with poor long-term outcomes following arthroscopic stabilization surgery.[7,8,29] The aim of the rehabilitation protocol outlined in the present study was to optimize active range of movement early in the rehabilitation process to enable the implementation of specific rehabilitation strategies addressing strength and proprioception. Although the early emphasis was on mobilization within a safe zone, this enabled early active mobilization and muscle recruitment into risk positions (the 'danger zone'). A clear limitation of the present study is that strength and proprioceptive measures to evaluate the efficacy of exercise intervention were not formalized. Strength measures had been routinely collected by the majority of club physiotherapists involved in the treatment of players, however we did not standardize the way in which they were measured and so they are not reported here. Nonetheless it was a prerequisite of return to play that players strength parameters matched previous performance levels and were equivalent to the opposite limb in test positions.

Further considerations

A review of the three players who reported a recurrence of instability following a further injury revealed that players had discontinued some of the remedial shoulder rehabilitation exercises once their shoulder felt 'normal'. Players were encouraged to continue simple recruitment exercises to reinforce the optimal timing of the rotator cuff and scapula muscles after they had returned to play. In addition, two of the players reported the occurrence of a lower limb injury in the weeks preceding shoulder recurrence. The persistence of proprioceptive and performance deficits for up to 2 years post stabilization surgery has been well documented.[30–32] However, without formal measurement of these parameters and a comparison of compliance with those players who did not 'fail', it is difficult to determine the efficacy of exercises that specifically aim to optimize efficiency of the dynamic stabilizers and sensorimotor system. The role of the kinetic chain and its impact on shoulder performance has received increasing interest in the literature.[33,34] Unfortunately, without standardized measures of strength and shoulder performance in this patient group (and a comparison of incidence of lower limb injuries in nonfailed players), it is not possible to truly evaluate the role of lower limb injury in predicting recurrence. It is clear that, in future studies, standardized and validated measures should be incorporated as part of follow-up to determine the efficacy of specific rehabilitation exercises and to monitor the performance of the shoulder after return to play.

Conclusions

Arthroscopic Bankart repair combined with an accelerated rehabilitation regime achieves early return to play

rates in a professional football population at a mean of 11 weeks. The recurrence rate at a mean follow-up of 4.8 years was 9%, which compares very favourably with other series of professional athletes for which more conservative rehabilitation approaches are employed. Communication between the surgeon and physiotherapist is essential in optimizing progression rates.

Declaration of Conflicting Interests

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References

1. Funk L. Arthroscopic shoulder surgery has progressed, has the rehabilitation? *Int Musculoskeletal Med* 2012; 34: 141–5.
2. Malhotra A, Freudmann MS and Hay SM. Management of traumatic anterior shoulder dislocation in the 17- to 25-year age group: a dramatic evolution of practice. *J Shoulder Elbow Surg* 2012; 21: 545–53.
3. Grant JA. Updating recommendations for rehabilitation after ACL reconstruction: a review. *Clin J Sport Med* 2013; 23: 501–2.
4. Ardern CL, Webster KE, Taylor NF and Feller JA. Return to sport following anterior cruciate ligament reconstruction surgery: a systematic review and meta-analysis of the state of play. *Br J Sports Med* 2011; 45: 596–606.
5. Gibson J. Rehabilitation after shoulder instability surgery. *Curr Orthop* 2004; 18: 197–209.
6. Brownson P, Donaldson O, Fox M, et al. BESS/BOA Patient Care Pathways: traumatic anterior shoulder instability. *Shoulder Elbow* 2015; 7: 214–26.
7. Ide J, Maeda S and Takagi K. Arthroscopic Bankart repair using suture anchors in athletes: patient selection and postoperative sports activity. *Am J Sports Med* 2004; 32: 1899–905.
8. Stein T, Linke RD, Buckup J, Efe T and von Eisenhart-Rothe R. Shoulder sport-specific impairments after arthroscopic Bankart repair. *Am J Sports Med* 2011; 39: 2404–14.
9. Wilk KE and Macrina LC. Non-operative and post-operative rehabilitation for gleno-humeral instability. *Clin Sports Med* 2013; 32: 865–914.
10. Nyland J. Effects of immobilization and disuse on the musculoskeletal system. *Clinical decisions in therapeutic exercise: planning and implementation*. Upper Saddle River, NJ: Prentice Hall, 2005.
11. Hortobágyi T, Dempsey L, Fraser D, Zheng D, Hamilton G and Lambert J. Changes in muscle strength, muscle fibre size and myofibrillar gene expression after immobilization and retraining in humans. *J Physiol* 2000; 524: 293–304.
12. Good CR and MacGilivray JD. Traumatic shoulder dislocation in the adolescent athlete: advances in surgical treatment. *Curr Opin Pediatr* 2005; 17: 25–9.
13. Castagna A, Delle Rose G, Borroni M, et al. Arthroscopic stabilization of the shoulder in adolescent athletes participating in overhead or contact sports. *Arthroscopy* 2012; 28: 309–15.
14. Olds M, Ellis R, Donaldson K, Parmar P and Kersten P. Risk factors which predispose first-time traumatic anterior shoulder dislocations to recurrent instability in adults: a systematic review and meta-analysis. *Br J Sports Med* 2015; 49: 913–22.
15. Kim SH, Ha KH, Jung MW, Lim MS, Kim YM and Park JH. Accelerated rehabilitation after arthroscopic Bankart Repair for selected cases: a prospective randomized clinical study. *Arthroscopy* 2003; 19: 722–31.
16. Law BK, Yung PS, Ho EP, Chang JJ and Chan KM. The surgical outcome of immediate arthroscopic Bankart repair for first time anterior shoulder dislocation in young active patients. *Knee Surg Sports Traumatol Arthrosc* 2008; 1: 188–93.
17. Randelli P, Ragone V, Carminati S and Cabitza P. Risk factors for recurrence after Bankart repair: a systematic review. *Knee Surg Sports Traumatol Arthrosc* 2012; 20: 2129–38.
18. Pritchard C, Mills S, Funk L and Batty P. Incidence and management of shoulder injuries in premier league professional football players. *Br J Sports Med* 2011; 45: A15.
19. Headey J, Brooks JH and Kemp SP. The epidemiology of shoulder injuries in English professional rugby union. *Am J Sports Med* 2007; 35: 1537–43.
20. Hart D and Funk L. Serious shoulder injuries in professional soccer: return to participation after surgery. *Knee Surg Sports Traumatol Arthrosc* 2015; 23: 2123–9.
21. Mazzocca AD, Brown FM, Carreira DS, Hayden J and Romeo AA. Arthroscopic anterior shoulder stabilization of collision and contact athletes. *Am J Sports Med* 2005; 33: 52–60.
22. Larrain MV, Montenegro HJ, Mauas DM, Collazo CC and Pavon F. Arthroscopic management of traumatic anterior shoulder instability in collision athletes: analysis of 204 cases with 4 to 9 year follow-up and results with the suture anchor technique. *Arthroscopy* 2006; 22: 1283–9.
23. Gerometta A, Rosso C, Klouche S, Hardy P. Arthroscopic Bankart shoulder stabilization in athletes: return to sports and functional outcomes. *Knee Surg Sports Traumatol Arthrosc* 2014 Apr 22. [Epub ahead of print].
24. Voos JE, Livermore RW, Feeley BT, et al. Prospective evaluation of arthroscopic Bankart repairs for anterior instability. *Am J Sports Med* 2010; 38: 302–7.
25. Wasserstein D, Dwyer T, Veillette C, et al. Predictors of dislocation and revision after shoulder stabilization in Ontario. *Am J Sports Med* 2013; 41: 2034–40.
26. Petrera M, Dwyer T, Tsuji MR and Theodoropoulos JS. Outcomes of arthroscopic Bankart repair in collision versus non-collision athletes. *Orthopedics* 2013; 36: 621–6.

27. Cho NS, Hwang JC and Rhee YG. Arthroscopic stabilization in anterior shoulder instability: collision athletes versus non-collision athletes. *Arthroscopy* 2006; 22: 947–53.
28. Flinkkila T, Hyvonen P, Ohtonen P and Leppilahti J. Arthroscopic Bankart repair: results and risk factors of recurrence of instability. *Knee Surg Sports Traumatol Arthrosc* 2010; 18: 1752–8.
29. Owens BD, Deberardino TM, Nelson BJ, et al. Long-term follow up of acute arthroscopic Bankart repair for initial anterior shoulder dislocations in young athletes. *Am J Sports Med* 2009; 37: 669–73.
30. Fremerey R, Bosch U, Freitag N, Lobenhoffer P and Wippermann B. Proprioception and EMG pattern after capsulolabral reconstruction in shoulder instability: a clinical and experimental study. *Knee Surg Sports Traumatol Arthrosc* 2006; 14: 1315–20.
31. Pötzl W, Thorwesten L, Götze C, Garmann S and Steinbeck J. Proprioception of the shoulder joint after surgical repair for instability: a long-term follow-up study. *Am J Sports Med* 2004; 32: 425–30.
32. Zuckerman JD, Gallagher MA, Cuomo F and Rokito A. The effect of instability and subsequent anterior shoulder repair on proprioceptive ability. *J Shoulder Elbow Surg* 2003; 12: 105–9.
33. Scher S, Anderson K, Weber N, Bajorek J, Rand K and Bey MJ. Associations among hip and shoulder range of motion and shoulder injury in professional baseball players. *J Athl Train* 2010; 45: 191–7.
34. Radiwan A, Francis J, Green A, et al. Is there a relation between shoulder dysfunction and core stability? *Int J Sports Phys Ther* 2014; 9: 8–13.